MAGNETORESISTANCE EFFECT DEVICE

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Abstract

PROBLEM TO BE SOLVED: To provide a large magnetoresistance effect by constituting one of first and second ferromagnetic conductive bodies of perovskite manganese oxide.
SOLUTION: A ferromagnetic conductive layer 2 is formed on a substrate 1 such that a part of the substrate 1 is exposed, and a first ferromagnetic conductive layer 3 is formed on the ferromagnetic conductive layer 2. A paramagnetic conductive layer 4 is formed on the first ferromagnetic conductive layer 3 with the part of the first ferromagnetic conductive layer 3 exposed and a second ferromagnetic conductive layer 5 formed on the paramagnetic conductive layer 4. One of the first ferromagnetic conductive layer 3 and the second ferromagnetic conductive layer 5 are constituted of perovskite manganese oxide, and the ferromagnetic conductive body made of perovskite manganese oxide enables a spin electrode on a Fermi surface to be increased by 50% or more.

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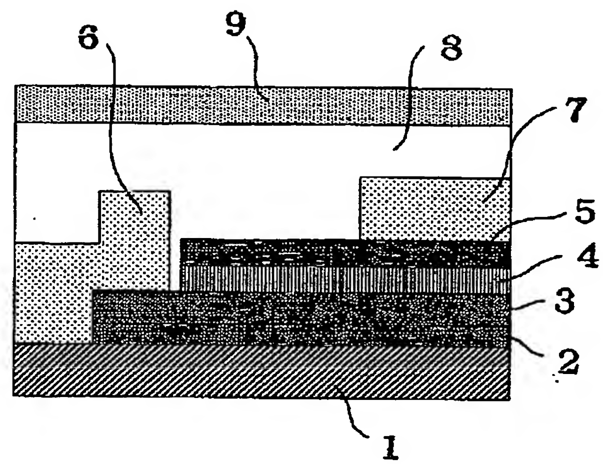
(54)【発明の名称】　磁気抵抗効果型素子

(57)【要約】
【課題】　本発明は、大きな磁気抵抗効果を有する磁気抵抗効果型素子を提供することが目的である。
【解決手段】　第１の強磁性導電体３と、非磁性導電体４と、第２の強磁性導電体５と、をこの順序で備える磁気抵抗効果型素子であって、前記第１、第２の強磁性導電体３、５の少なくとも一方がペロブスカイト型マンガン酸化物からなる。



【特許請求の範囲】
【請求項1】　第1の強磁性導電体と、非磁性導電体と、第2の強磁性導電体と、をこの順序で備える磁気抵抗効果型素子であって、前記第1、第2の強磁性導電体の少なくとも一方がペロブスカイト型マンガン酸化物からなることを特徴とする磁気抵抗効果型素子。
【請求項2】　前記非磁性導電体は、ペロブスカイト型酸化物からなることを特徴とする請求項1記載の磁気抵抗効果型素子。
【請求項3】　第1の強磁性導電体と、非磁性導電体と、第2の強磁性導電体と、をこの順序で備える磁気抵抗効果型素子であって、前記第1、第2の強磁性導電体の少なくとも一方がフェルミ面上でのスピン偏極が50%以上100%以下であることを特徴とする磁気抵抗効果型素子。
【発明の詳細な説明】
【0001】
【発明の属する技術分野】本発明は磁気抵抗効果型素子に関する。
【0002】
【従来の技術】近年、強磁性金属、非磁性金属、強磁性金属をこの順序に積層した金属人工格子を備えた、巨大磁気抵抗効果（GMR）を利用する磁気抵抗効果型素子が活発に研究されている。
【0003】上記金属人工格子としては、例えばFe／Cu／Fe、Co／Cu／Co、パーマロイ／Cu／パーマロイなどが代表的なものとして知られている。
【0004】斯る磁気抵抗効果型素子はハードディスク用のMRヘッドとして注目を集めている他、前記非磁性金属を挟む両強磁性金属のスピン方向の違いに起因する抵抗値の変化を利用した新規なトランジスタとしてのスピントランジスタの研究が開始されている。
【0005】
【発明が解決しようとする課題】しかしながら、上記MRヘッドはより高密度な記録媒体を再生するためにも、より磁気抵抗効果が大きいことが望まれている。
【0006】また、上記スピントランジスタはより利得を上げるため、またメモリとして使用するタイプではそのメモリ機能の信頼性を向上させるために、より磁気抵抗効果が大きいことが要求される。
【0007】本発明は上述の問題点を鑑み成されたものであり、より大きな磁気抵抗効果を有する磁気抵抗効果型素子を提供することが目的である。
【0008】
【課題を解決するための手段】本発明の磁気抵抗効果型素子は、第1の強磁性導電体と、非磁性導電体と、第2の強磁性導電体と、をこの順序で備える磁気抵抗効果型素子であって、前記第1、第2の強磁性導電体の少なくとも一方がペロブスカイト型マンガン酸化物からなることを特徴とする。
【0009】本発明は、第1、第2の強磁性導電体の少なくとも一方がペロブスカイト型マンガン酸化物からなる。このペロブスカイト型マンガン酸化物からなる強磁性導電体はフェルミ面上のスピン偏極を大きく、50%以上、更に言えば70%台から略100%にすることが可能である。従って、本発明の磁気抵抗効果型素子の磁気抵抗効果が大幅に大きくなる。
【0010】この結果、この磁気抵抗効果型素子をMRヘッドとして用いる場合、より高密度記録媒体の再生が可能となる。また、この磁気抵抗効果型素子をスピントランジスタとして用いる場合、利得の大幅な向上やメモリ機能の信頼性の向上が可能となる。
【0011】更に、第1、第2の強磁性導電体の両方がペロブスカイト型マンガン酸化物からなることが好ましい。
【0012】また、第1、第2の強磁性導電体の一方にペロブスカイト型マンガン酸化物を用いる場合、電子注入側の強磁性導電体にペロブスカイト型マンガン酸化物を用いるのが伝導電子のスピンの偏極が大きくなるので好ましい。
【0013】上記ペロブスカイト型マンガン酸化物としては、$LaSrMnO_3$、$PrCaMnO_3$、又は$NdSrMnO_3$等が利用可能である。
【0014】特に、上記非磁性導電体は、ペロブスカイト型酸化物からなることを特徴とする。このペロブスカイト型酸化物としては、Nb高ドープの$SrTiO_3$、又はLa高ドープの$SrTiO_3$等が利用可能である。
【0015】この場合、製造が容易になると共に、素子特性の劣化を抑制できる。
【0016】更に、上記第1、第2の強磁性導電体、上記非磁性導電体、更には反強磁性体を形成するための基板としては、ペロブスカイト型酸化物を用いるのが好ましい。この基板としては、$SrTiO_3$基板を用いてよい。
【0017】この場合、更に製造が容易になると共に、素子特性の劣化を抑制できる。
【0018】また、第1、第2の強磁性導電体のいずれか一方の外側には、この外側に位置する第1の強磁性導電体又は第2の強磁性導電体の磁化を一方向に揃え、固定するための反強磁性体を備えるのが好ましく、より好ましくは密接させるのがよい。この反強磁性体としては、ペロブスカイト型マンガン酸化物を用いるのが好ましい。斯る反強磁性体としては、$PrCaMnO_3$、$LaCaMnO_3$を用いてよい。
【0019】本発明の磁気抵抗効果型素子は、第1の強磁性導電体と、非磁性導電体と、第2の強磁性導電体と、をこの順序で備えるスピン素子であって、前記第1、第2の強磁性導電体の少なくとも一方がフェルミ面上でのスピン偏極が50%以上100%以下であることを特徴とする。

【0020】本発明は、少なくとも一方の強磁性導電体はフェルミ面上のスピン偏極が50％以上と大きいので、磁気抵抗効果が大幅に大きくなる。

【0021】この結果、この磁気抵抗効果型素子をMRヘッドとして用いる場合、より高密度記録媒体の再生が可能となる。また、この磁性体素子をスピントランジスタとして用いる場合、利得の大幅な向上やメモリ機能の信頼性の向上が可能となる。

【0022】更に、第1、第2の強磁性導電体の両方がフェルミ面上でのスピン偏極が50％以上100％以下であることが望ましい。

【0023】また、本発明の磁気抵抗効果型素子は、第1、第2の強磁性導電体間に電流が流れるようにして抵抗変化を検出するための電極を備えてもよい。

【0024】更に、本発明の磁気抵抗効果型素子をメモリ素子として使用する場合は、第1、第2の強磁性導電体のうち、磁化が固定されていない方の磁化方向を変えるために、外部磁場発生手段が準備され、この手段としてこの素子の近傍に導電線を備えるようにしてよい。

【0025】また、第1、第2の強磁性導電体の一方がフェルミ面上でのスピン偏極が50％以上100％以下である場合、電子注入側の強磁性導電体にスピン偏極が50％以上100％以下であるものを、即ちスピン偏極が大きいものを用いるのが伝導電子のスピンの偏極を大きくできるので好ましい。

【0026】本発明の第1、第2の強磁性導電体には強磁性金属を、非磁性導電体には非磁性金属を使える。

【0027】

【発明の実施の形態】本発明の一実施形態に係る磁気抵抗効果を用いたメモリ素子としてのスピントランジスタについて詳細に説明する。図1は本実施形態のスピントランジスタの概略模式構成図である。

【0028】図1中、1は$SrTiO_3$基板、2は基板1上に1部を露出した状態で形成された100Å厚の$Pr_{1-x}Ca_xMnO_3$（$PrCaMnO_3$と略記する。：$0.3<x<0.5$）からなる反強磁性導電体層、3は反強磁性導電体層2上に形成されたは200～500Å厚の$La_{1-x}Sr_xMnO_3$（$LaSrMnO_3$と略記する。：$0.16<x<0.5$）からなる第1の強磁性導電体層、4は第1の強磁性導電体層3の一部を露出してこの第1の強磁性導電体層3上に形成された100～500Å厚の$SrTiO_3$（Nbドープ、ドープ量：0．01～0．5wt％）からなる常磁性導電体層（非磁性導電体層）、5は常磁性導電体層4上に形成された200～500Å厚の$LaSrMnO_3$からなる第2の強磁性導電体層である。

【0029】6は前記露出した基板1上から前記露出した第1の強磁性導電体層3上に連なって形成された2000Å厚の金からなる電極、7は第2の強磁性導電体層5上に形成された2000Å厚の金からなる電極である。この素子では、前記電極6とこれと対をなす前記電極7とで電気抵抗変化を検出する。尚、本実施形態では、第1の強磁性導電体層3側の電極6を電子の注入側とし、第2の強磁性導電体層5側の電極7を電子の出る側となるように構成している。

【0030】8は前記電極6、常磁性導電体層4、第2の強磁性導電体層5、電極7上を覆う1μm厚のレジストからなる絶縁層、9は絶縁層8上に形成された図1中紙面の垂直方向に延在する1000Å厚の金からなる磁場発生のための導電線である。

【0031】この磁気抵抗効果型素子であるスピントランジスタは、反強磁性導電体層2が第1の強磁性導電体層3の磁化（スピン）方向を一方向に固定化するための層である。よって、この反強磁性導電体層2の存在により第1の強磁性導電体層3の磁化方向は一方向に強く固定される。本実施形態の場合、第1の強磁性導電体層3の磁化方向は導電線9の延在方向に垂直方向に固定されている。

【0032】一方、前記第2の強磁性導電体層5は、第1の強磁性導電体層3に比べ磁化方向が外部磁場によって変化しやくすく構成されている。

【0033】従って、前記導電線9に電流が印加されることによって、その周囲、具体的には第2の強磁性導電体層5に及ぶ磁場が発生する。この磁場の方向は電流の流れる方向を正逆にすることによって反転するので、導電線9に電流の流れる方向を選択して印加することにより、第1の強磁性導電体層3の磁化方向と第2の強磁性導電体層5の磁化方向を同方向及び逆方向のいずれか一方になるように選択できる。

【0034】第1の強磁性導電体層3の磁化方向と第2の強磁性導電体層5の磁化方向が逆方向である場合、電極6、7による電気抵抗は大きく検出され、第1の強磁性導電体層3の磁化方向と第2の強磁性導電体層5の磁化方向が同方向である場合、電極6、7による電気抵抗は小さく検出される。

【0035】即ち、例えば、第1の強磁性導電体層3の磁化方向と第2の強磁性導電体層5の磁化方向が逆方向の場合を「0」とし、前記磁化方向が同方向の場合を「1」として、デジタル的なメモリ素子として用いられる。

【0036】斯る磁気抵抗効果型素子では、第1、第2の強磁性導電体層3、5に用いられているペロブスカイト型マンガン酸化物は、スピン偏極が70％程度と他の強磁性導電体（例えば、パーマロイや鉄などのスピン偏極は、せいぜい10％程度）に比べて遥かに大きい。

【0037】従って、このように第1、第2の強磁性導電体層3、5では、電子のスピン偏極が大きいので、第1、第2の強磁性導電体層3、5の中には伝導電子との散乱に強く相関する磁化方向にスピン整列された電子が多く存在する。しかも、第1の強磁性導電体層3から注

入される電子（即ち伝導電子）も第1の強磁性導電体層3を経るので、伝導電子のスピンも第1の強磁性導電体層3の磁化方向に整列されたものが多くなる。

【0038】そして、第1、第2の強磁性導電体層3、5中の電子のスピン方向が平行の場合は、該スピン方向と平行のスピンをもつ伝導電子との散乱断面積は小さく、第1、第2の強磁性導電体層3、5中の電子のスピン方向が逆方向の場合は伝導電子との散乱断面積が大きくなるので、従来に比べてスピン整列がなされるようにしている本発明は、従来に比べ、第1の強磁性導電体層3の磁化方向と第2の強磁性導電体層5の磁化方向が同方向の場合には、抵抗がより小さく、逆方向の場合は抵抗が大きくなる。この結果、メモリの信頼性が従来に比べ向上する。

【0039】しかも、基板1、常磁性導電体層4は第1、第2の強磁性導電体層3、5と同様のペロブスカイト型酸化物であり、反強磁性導電体層2は第1、第2の強磁性導電体層3、5と同様のペロブスカイト型マンガン酸化物で構成しているので、製造が容易で、素子に歪み等を小さくでき、素子特性の低下を抑制できる。

【0040】上述の第1、第2の強磁性導電体層3、5には上記ＬａＳｒＭｎO_3に代えて、温度150Ｋより小さい環境下でＰr_{1-x}Ｃa_xＭｎO_3（0．13＜ｘ＜0．3）を用いてもよく、その他にＮ$d_{0.5}$Ｓ$r_{0.5}$ＭｎO_3や（Ｎ$d_{0.06}$Ｓ$m_{0.94}$）$_{0.5}$Ｓ$r_{0.5}$ＭｎO_3など適宜使用できる。

【0041】更に、非磁性導電体層4には、Ｎｂドープに代えて同様のドープ量のＬａドープのものを使用してもよい。

【0042】また、反強磁性導電体層2にはＬ$a_{0.5}$Ｃ$a_{0.5}$ＭｎO_3などを使用してもよい。上記第1、第2の強磁性導電体層3、5の少なくとも一方をペロブスカイト型マンガン酸化物で構成しても効果はあるが、本実施形態のように両方ともペロブスカイト型マンガン酸化物で構成した方がより効果がある。

【0043】上述のように少なくとも一方にペロブスカイト型マンガン酸化物を用いる場合、電子注入側の強磁性導電体層にペロブスカイト型マンガン酸化物を用いるのが伝導電子のスピンの偏極が大きくなるので好ましい。

【0044】また、上述の実施形態では、メモリ素子としての磁気抵抗効果型素子について説明したが、本発明はＭＲヘッド等の他の機能をもつ素子にも適用できる。

【0045】

【発明の効果】本発明は、大きな磁気抵抗効果を有する磁気抵抗効果型素子を提供することができる。

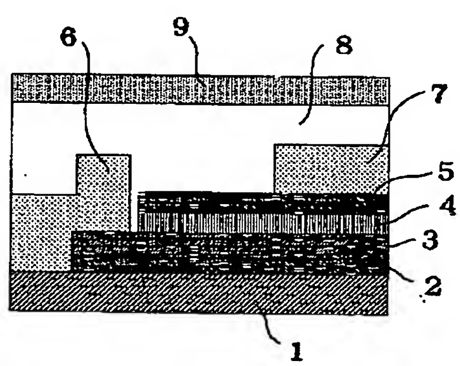
【図面の簡単な説明】

【図1】本発明の一実施形態に係る磁気抵抗効果型素子の概略模式構成図である。

【符号の説明】

3　第1の強磁性導電体層
4　非磁性体層
5　第2の強磁性導電体層

【図1】



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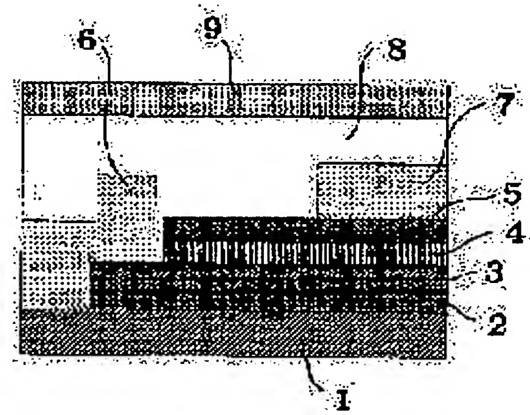

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CLAIMS

[Claim(s)]
[Claim 1] The magneto-resistive effect mold component which is a magneto-resistive effect mold component equipped with the 1st ferromagnetic conductor, a nonmagnetic conductor, and the 2nd ferromagnetic conductor in this sequence, and is characterized by at least one side of the said 1st and 2nd ferromagnetic conductor consisting of a perovskite mold manganic acid ghost.
[Claim 2] Said nonmagnetic conductor is a magneto-resistive effect mold component according to claim 1 characterized by consisting of a perovskite mold oxide.
[Claim 3] The magneto-resistive effect mold component to which it is the magneto-resistive effect mold component equipped with the 1st ferromagnetic conductor, a nonmagnetic conductor, and the 2nd ferromagnetic conductor in this sequence, and spin polarization on a Fermi surface is characterized by 50% or more being 100% or less by at least one side of the said 1st and 2nd ferromagnetic conductor.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a magneto-resistive effect mold component.
[0002]
[Description of the Prior Art] In recent years, the magneto-resistive effect mold component using giant magneto-resistance (GMR) equipped with the metal artificial grid which carried out the laminating of a ferromagnetic metal, non-magnetic metal, and the ferromagnetic metal to this sequence is studied actively.
[0003] As the above-mentioned metal artificial grid, Fe/Cu/Fe, Co/Cu/Co, a permalloy / Cu / permalloy, etc. are known as a typical thing, for example.
[0004] The **** magneto-resistive effect mold component attracts attention as an MR head for hard disks, and also research of the spin transistor as a new transistor using the resistance value change resulting from the difference in the spin direction of both the ferromagnetism metal that sandwiches said non-magnetic metal is started.
[0005]
[Problem(s) to be Solved by the Invention] However, also in order for the above-mentioned MR head to reproduce a higher-density record medium, it is desired for a magneto-resistive effect to be more large.
[0006] Moreover, in order that the above-mentioned spin transistor may raise gain more, and in order to raise the dependability of the memory function by the type used as memory, it is required that a magneto-resistive effect should be more large.
[0007] It is the object to offer the magneto-resistive effect mold component which accomplishes this invention in view of an above-mentioned trouble, and has a bigger magneto-resistive effect.
[0008]
[Means for Solving the Problem] The magneto-resistive effect mold component of this invention is a magneto-resistive effect mold component equipped with the 1st ferromagnetic conductor, a nonmagnetic conductor, and the 2nd ferromagnetic conductor in this sequence, and is characterized by at least one side of the said 1st and 2nd ferromagnetic conductor consisting of a perovskite mold manganic acid ghost.
[0009] As for this invention, at least one side of the 1st and 2nd ferromagnetic conductor consists of a perovskite mold manganic acid ghost. If the ferromagnetic conductor which consists of this perovskite mold manganic acid ghost is large and the spin polarization on a Fermi surface is said further 50% or more, it can be made 100% of abbreviation from the base of 70%. Therefore, the magneto-resistive effect of the magneto-resistive effect mold component of this invention becomes large substantially.
[0010] Consequently, when using this magneto-resistive effect mold component as an MR head, it becomes more reproducible [a high density record medium]. Moreover, when using this magneto-resistive effect mold component as a spin transistor, the large improvement in gain and improvement in the dependability of a memory function are attained.
[0011] Furthermore, it is desirable that both 1st and 2nd ferromagnetic conductor consists of a perovskite mold manganic acid ghost.
[0012] Moreover, when using a perovskite mold manganic acid ghost for one side of the 1st and 2nd ferromagnetic conductor, since the polarization of the spin of conduction electron becomes large, it is desirable [polarization] to use a perovskite mold manganic acid ghost for the ferromagnetic conductor by the side of electron injection.

[0013] As the above-mentioned perovskite mold manganic acid ghost, LaSrMnO3, PrCaMnO3, or NdSrMnO3 grade is available.
[0014] Especially the above-mentioned nonmagnetic conductor is characterized by consisting of a perovskite mold oxide. As this perovskite mold oxide, the SrTiO3 grade of SrTiO3 of Nb high dope or La high dope is available.
[0015] In this case, while manufacture becomes easy, degradation of a component property can be controlled.
[0016] Furthermore, as the above 1st, the 2nd ferromagnetic conductor, the above-mentioned nonmagnetic conductor, and a substrate for forming the antiferromagnetic substance further, it is desirable to use a perovskite mold oxide. SrTiO3 substrate may be used as this substrate.
[0017] In this case, while manufacture becomes easy further, degradation of a component property can be controlled.
[0018] Moreover, it is good for one outside of the 1st and 2nd ferromagnetic conductor to make it close preferably [arranging with an one direction magnetization of the 1st ferromagnetic conductor located in this outside, or the 2nd ferromagnetic conductor, and having the antiferromagnetic substance for fixing], and more preferably. As this antiferromagnetic substance, it is desirable to use a perovskite mold manganic acid ghost. PrCaMnO3 and LaCaMnO3 may be used as the **** antiferromagnetic substance.
[0019] The magneto-resistive effect mold component of this invention is a spin component equipped with the 1st ferromagnetic conductor, a nonmagnetic conductor, and the 2nd ferromagnetic conductor in this sequence, and spin polarization on a Fermi surface is characterized by being 100% or less by at least one side of the said 1st and 2nd ferromagnetic conductor 50% or more.
[0020] In this invention, since the spin polarization on a Fermi surface is as large as 50% or more, as for one [at least] ferromagnetic conductor, a magneto-resistive effect becomes large substantially.
[0021] Consequently, when using this magneto-resistive effect mold component as an MR head, it becomes more reproducible [a high density record medium]. Moreover, when using this magnetic-substance component as a spin transistor, the large improvement in gain and improvement in the dependability of a memory function are attained.
[0022] Furthermore, it is desirable for both 1st and 2nd ferromagnetic conductor to be [for the spin polarization on a Fermi surface] 100% or less 50% or more.
[0023] Moreover, the magneto-resistive effect mold component of this invention may be equipped with the electrode for detecting resistance change between the 1st and 2nd ferromagnetic conductor, as a current flows.
[0024] Furthermore, when using the magneto-resistive effect mold component of this invention as a memory device, in order to change the magnetization direction of the direction where magnetization is not being fixed among the 1st and 2nd ferromagnetic conductor, an external magnetic field generating means is prepared and you may make it have an electric conduction line near this component as this means.
[0025] Moreover, when one side of the 1st and 2nd ferromagnetic conductor is [the spin polarization on a Fermi surface] 100% or less 50% or more, since using for the ferromagnetic conductor by the side of electron injection the thing has large spin polarization and whose spin polarization is 100% or less 50% or more, i.e., what, can enlarge polarization of the spin of conduction electron, it is desirable.
[0026] A ferromagnetic metal can be used for the 1st of this invention, and the 2nd ferromagnetic conductor, and non-magnetic metal can be used for a nonmagnetic conductor.
[0027]
[Embodiment of the Invention] The spin transistor as a memory device using the magneto-resistive effect concerning 1 operation gestalt of this invention is explained to a detail. Drawing 1 is the ****** type block diagram of the spin transistor of this operation gestalt.
[0028] It is Pr1-xCaxMnO3 (it is written as PrCaMnO3.) of 100A thickness formed after one exposed SrTiO3 substrate on the substrate 1 among drawing 1 and 2 had exposed the one section. : It is La1-xSrxMnO3 (it is written as LaSrMnO3.) of 200-500A thickness of 0.3< ** by which the antiferromagnetism conductor layer which consists of x< 0.5, and 3 were formed on the antiferromagnetism conductor layer 2. : The 1st ferromagnetic conductor layer which consists of 0.16< x<0.5, and 4 are SrTiO3 (a Nb dope) of 100-500A thickness which exposed a part of 1st ferromagnetic conductor layer 3, and was formed on this 1st ferromagnetic conductor layer 3. The amount of dopes: The paramagnetism conductor layer (nonmagnetic conductor layer) which consists of 0.01 - 0.5wt%, and 5 are 2nd ferromagnetic conductor layer which consists

of LaSrMnO3 of 200-500A thickness formed on the paramagnetism conductor layer 4.

[0029] The electrode which consists of gold of 2000A thickness formed by 6 standing in a row on said 1st exposed ferromagnetic conductor layer 3 from on said exposed substrate 1, and 7 are electrodes which consist of gold of 2000A thickness formed on the 2nd ferromagnetic conductor layer 5. With this component, said electrode 6 and this, and said electrode 7 which makes a pair detect electric resistance change. In addition, the electrode 6 by the side of the 1st ferromagnetic conductor layer 3 is made into an electron impregnation-side, and it constitutes from this operation gestalt so that it may become the side to which an electron comes out of the electrode 7 by the side of the 2nd ferromagnetic conductor layer 5.

[0030] The insulating layer which 8 becomes from the resist of 1 micrometer thickness of wraps about a said electrode 6, paramagnetism conductor layer 4, 2nd ferromagnetic conductor layer 5, and electrode 7 top, and 9 are the electric conduction lines for magnetic field generating which consists of gold of 1000A thickness which extends to the perpendicular direction of the space in drawing 1 formed on the insulating layer 8.

[0031] The spin transistor which is this magneto-resistive effect mold component is a layer for the antiferromagnetism conductor layer 2 to fix the magnetization (spin) direction of the 1st ferromagnetic conductor layer 3 in an one direction. Therefore, the magnetization direction of the 1st ferromagnetic conductor layer 3 is strongly fixed in an one direction by existence of this antiferromagnetism conductor layer 2. In the case of this operation gestalt, the magnetization direction of the 1st ferromagnetic conductor layer 3 is being perpendicularly fixed in the extension direction of the electric conduction line 9.

[0032] On the other hand, compared with the 1st ferromagnetic conductor layer 3, the magnetization direction changes with external magnetic fields, burns said 2nd ferromagnetic conductor layer 5, becomes empty as for it, and it is constituted.

[0033] Therefore, the perimeter and the magnetic field which specifically attains to the 2nd ferromagnetic conductor layer 5 occur by impressing a current to said electric conduction line 9. the direction where, as for the direction of this magnetic field, a current flows -- forward -- since it is reversed by making it reverse, the magnetization direction of the 1st ferromagnetic conductor layer 3 and the magnetization direction of the 2nd ferromagnetic conductor layer 5 can be chosen by choosing and impressing the direction where a current flows to the electric conduction line 9 so that it may become either this direction and hard flow.

[0034] When the magnetization direction of the 1st ferromagnetic conductor layer 3 and the magnetization direction of the 2nd ferromagnetic conductor layer 5 are hard flow, the electric resistance by electrodes 6 and 7 is detected greatly, and when the magnetization direction of the 1st ferromagnetic conductor layer 3 and the magnetization direction of the 2nd ferromagnetic conductor layer 5 are these directions, the electric resistance by electrodes 6 and 7 is detected small.

[0035] That is, it is used as a digital memory device, setting to "0" the case where the magnetization direction of the 1st ferromagnetic conductor layer 3 and the magnetization direction of the 2nd ferromagnetic conductor layer 5 are hard flow, for example, and using as "1" the case where said magnetization direction is this direction.

[0036] The perovskite mold manganic acid ghost used for the 1st and 2nd ferromagnetic conductor layer 3 and 5 with the **** magneto-resistive effect mold component has far large spin polarization compared with about 70% and other ferromagnetic conductors (spin polarization, such as a permalloy and iron, is about at most 10%).

[0037] Therefore, in this way, in the 1st and 2nd ferromagnetic conductor layer 3 and 5, since electronic spin polarization is large, many electrons by which spin alignment was carried out exist in the magnetization direction strongly correlated in dispersion with conduction electron in the 1st and 2nd ferromagnetic conductor layer 3 and 5. And since the electron (namely, conduction electron) poured in from the 1st ferromagnetic conductor layer 3 also passes through the 1st ferromagnetic conductor layer 3, that to which the spin of conduction electron also aligned in the magnetization direction of the 1st ferromagnetic conductor layer 3 increases.

[0038] And when the 1st, the 2nd ferromagnetic conductor layer 3, and the spin direction of the electron in five are parallel Since a scattering cross section with conduction electron becomes large when the scattering cross section of this spin direction and conduction electron with parallel spin is small and the 1st, the 2nd ferromagnetic conductor layer 3, and the spin direction of the electron in five are hard flow This invention by which spin alignment is made to be made compared with the former has more small resistance, when the

magnetization direction of the 1st ferromagnetic conductor layer 3 and the magnetization direction of the 2nd ferromagnetic conductor layer 5 are these directions compared with the former, and resistance becomes large when it is hard flow. Consequently, the dependability of memory improves compared with the former.
[0039] And a substrate 1 and the paramagnetism conductor layer 4 are the same perovskite mold oxide as the 1st and 2nd ferromagnetic conductor layer 3 and 5, and since the antiferromagnetism conductor layer 2 is constituted from the same perovskite mold manganic acid ghost as the 1st and 2nd ferromagnetic conductor layer 3 and 5, manufacture is easy, can make distortion etc. small at a component, and can control lowering of a component property.
[0040] It may replace with the above $LaSrMnO_3$ at the above-mentioned 1st and 2nd ferromagnetic conductor layer 3 and 5, and $Pr_{1-x}Ca_xMnO_3$ ($0.13< x<0.3$) may be used under an environment smaller than temperature 150K, in addition $Nd_{0.5}Sr_{0.5}MnO_3$, $0.5(Nd_{0.06}Sm_{0.94})Sr_{0.5}MnO_3$, etc. can be used suitably.
[0041] Furthermore, it may replace with Nb dope and the thing of La dope of the same amount of dopes may be used for the nonmagnetic conductor layer 4.
[0042] Moreover, La0.5calcium0.5MnO3 etc. may be used for the antiferromagnetism conductor layer 2. Although it is effective even if it constitutes at least one side of the above 1st and the 2nd ferromagnetic conductor layer 3 and 5 from a perovskite mold manganic acid ghost, the direction which constituted both from a perovskite mold manganic acid ghost is more effective like this operation gestalt.
[0043] When using a perovskite mold manganic acid ghost at least for one side as mentioned above, since the polarization of the spin of conduction electron becomes large, it is desirable to use a perovskite mold manganic acid ghost for the ferromagnetic conductor layer by the side of electron injection.
[0044] Moreover, with an above-mentioned operation gestalt, although the magneto-resistive effect mold component as a memory device was explained, this invention is applicable also to a component with other functions, such as an MR head.
[0045]
[Effect of the Invention] This invention can offer the magneto-resistive effect mold component which has a big magneto-resistive effect.

[Translation done.]

* NOTICES *

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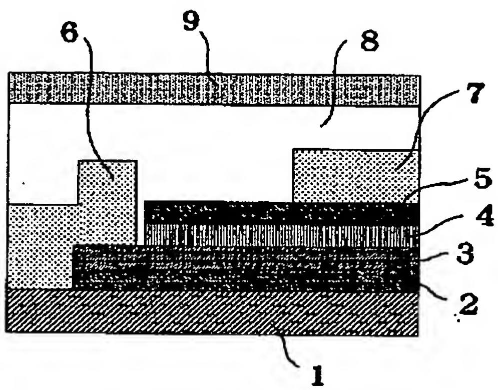
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



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